

A Review of the *Haliotis* of Yemen and Oman with Description of a New Species, *Haliotis arabiensis*, from Oman and United Arab Emirates

Buzz Owen ¹ Wilco Regter ² & Kirsten Van Laethem ³

¹ P.O. Box 601, Gualala, CA 95445, USA
buzabman@mcn.org

² Tongelaer 109, 2181 LW Hillegom, Netherlands
wilco-regter@hotmail.com

³ Heistraat 77, 9100 Sint-Niklaas B, Belgium
bozzelbubbels@gmail.com

ABSTRACT A new species, *Haliotis arabiensis* from Oman and United Arab Emirates is described and illustrated with a high resolution photo plate. Three taxa found along the southern and eastern Arabian Peninsula, two in Oman and the United Arab Emirates, *Haliotis mariae* W. Wood, 1828, and *Haliotis unilaterialis* Lamarck, 1822, and one in Yemen, *Haliotis rugosa multiperforata* Reeve, 1846, are reviewed and compared with the new species. Three additional plates illustrate the other southern and eastern Arabian Peninsula *Haliotis*. A fifth plate provides a differential diagnosis of the four taxa.

INTRODUCTION The abalones (Haliotidae) are a family of marine vetigastropods that until recently included 74 taxa (species and subspecies). Many of the subspecies considered valid species prior to a recent reappraisal in Geiger & Owen (2012) were later subsumed into existing species. Currently, the family consists of 55 extant species, with three species currently known from the southern and eastern Arabian Peninsula: *Haliotis mariae*, *H. unilaterialis*, and a subspecies of *H. rugosa*, *H. rugosa multiperforata* (Geiger & Owen, 2012; Owen, 2014; Owen & Pan, 2016). Only one of these species, *H. mariae*, is abundant, large in size, and is the subject of an important commercial fishery industry in Oman (Al-Rashdi & Iwao, 2008). *Haliotis unilaterialis* is a small, uncommon, but widespread species in the Western Indian Ocean, including the Red Sea and Gulf of Oman (Geiger & Owen, 2012). *Haliotis rugosa multiperforata* is an endemic subspecies of *H. rugosa* restricted to the Hadhramaut and Mahrah coasts of Yemen (Owen & Pan, 2016). *Haliotis rugosa*

multiperforata was formerly considered *H. pustulata* Reeve, 1846, and later *Haliotis rugosa pustulata*, but based on comparisons with *H. rugosa pustulata*, *H. rugosa rugosa*, and *H. rugosa rodriguensis*, the taxon from Yemen differed markedly and was given a new subspecific designation (Ali *et al.*, 2009; Geiger & Owen, 2012; Owen, 2013; Owen & Pan, 2016.) Based on these taxa, the southern Arabian Peninsula shows a remarkable amount of species richness in terms of its abalone fauna, particularly for a tropical marine realm in a restricted geographic area. Here we describe a new species of *Haliotis* which is endemic to the southeastern Arabian Peninsula (Oman and United Arab Emirates) that until recently was interpreted as juveniles of *Haliotis mariae*.

Abbreviations of Collections: BOC: Buzz Owen Collection, Gualala, California, USA; NMNZ: Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand; WRC: Wilco Regter Collection, Hillegom, Netherlands; KVLK: Kirsten Van Laethem Collection, Sint-Niklaas, Belgium; RKC: Robert Kershaw

Collection, Narooma, New South Wales, Australia; ARC: Arjay Raffety Collection, Marina del Rey, California, USA; CASIZ: California Academy of Sciences, Invertebrate Zoology, San Francisco, California, USA. All shells BOC unless otherwise indicated on Figures.

Shells examined: *H. arabiensis* n. sp., N. Salalah, Oman, to Dibba area of N. Fujairah, United Arab Emirates, 38; *H. mariae*, S. Oman, >500; *H. unilateralis*, Red Sea to Mozambique, >50; *H. unilateralis*, South Oman to United Arab Emirates, 3; *H. rugosa multiperforata*, Broom to Nishtun, Yemen, 26.

Genus *Haliotis* Linnaeus, 1758

Type species. *Haliotis asinina* Linnaeus, 1758 (subsequent designation Montfort, 1810)

***Haliotis arabiensis* Owen, Regter & Van Laethem, new species.**

Type material: Holotype: NMNZ M.319015 (Figure 1.1-2), 25.1 mm. Paratypes: BOC 0952 (Figure 1.4-5), 27.5 mm; WRC 0951 (Figure 1.3), 22.5 mm, from type locality.

Additional specimens: Figure 1.6-7 BOC; Figure 1.8 RKC; Figure 1.9-12 BOC; Figure 5.1 BOC; Figure 5.2 RKC; Figure 5.3 BOC. All Type locality. Figure 1.13 ARC; Figure 1.14-15 BOC; Figure 5.5 ARC; Figure 5.4,6 BOC. All N. Fujairah, United Arab Emirates.

Type locality: North Salalah, South Oman: 17° 01' 97" N, 54° 08' 97" E.

Etymology: The species is named after the Arabian Peninsula where all specimens were found.

Distribution and Habitat: All specimens live-taken by SCUBA diving. Depth 12-18 m. Under rocks and coral. No animals were preserved or studied.

Description (diagnostic characters underlined): Shell small (to ~35-40 mm), medium-weight, oblong, hardly arched, quite flat. Anterior margin slightly curved. Spire somewhat elevated and tilted, located approximately 65% towards posterior margin of shell; visible in ventral view (Figure 1.2, 1.5, 5.3, 5.6). Holes fairly large, elevated, slightly elongate, usually 4, sometimes 5 open. Dorsal surface usually with strong spiral ribbing, cords becoming more pronounced and deeper approaching spire. Periphery between row of holes and columella with 3-4 wide, deep cords in area closest to columella, with one or two weaker and narrower ribs closest to holes. A pronounced ridge separates the two areas. Columella narrow. Color medium to dark red; sometimes greyish purple with scattered whitish patches; occasional specimens almost pure green; may be marked with radial patches of yellowish white sometimes tinged with patches of orange. Specimens from United Arab Emirates are tan to brown marked with white patches. Ventral surface with highly iridescent silver nacre and reflections of green, pink, and steel blue. Usually pronounced strong ribbing and/or lumpiness visible showing through from dorsal surface. No muscle scar.

Comparisons: *Haliotis mariae* (also known locally as Sufailah) (Figure 2) is a larger species that can reach shell sizes in excess of 140 mm, has 5-6 much smaller, slightly elevated, closely spaced holes, and possesses weaker, narrower spiral ribbing, with the spire located closer to the posterior end of the shell (Figure 2). It lacks the strong thick cords in the peripheral area between the holes and columella. In addition, this species differs from *Haliotis arabiensis* in

coloration. The shells of *H. mariae* typically are dark brown with large whitish chevron markings, occasionally having lime green colors as well.

Haliotis unilateralis (Figure 3) is quite flat and generally smooth or has "bumps" often arranged in radial raised areas; very rarely has even weak spiral ribs. The periphery between the holes and columella has a wide rib in center extending well away from shell usually forming a prominent ridge, with 1-3 weaker ribs above

and below it. The spire is positioned closer to the center of the shell.

Haliotis rugosa multiperforata (Yemeni specimens were formerly considered *H. rugosa pustulata*) (Figure 4) has 6-8 smaller slightly elevated holes, weaker and narrower spiral ribbing, and is smooth, lacking strong, wide cords in the peripheral area between the holes and columella. It is generally dark brown in color with irregular markings of greenish-white. Red colored specimens have not been observed.



Figure 6 Distribution Map Key

- = *Haliotis arabiensis* n. sp.
- = *Haliotis mariae*
- = *Haliotis unilateralis*
- = *Haliotis rugosa multiperforata*

Remarks. One of the authors (K. Van Laethem) has conducted extensive malacological surveys and collecting of the intertidal and beach communities in Dhofar and adjacent coastal areas of Oman. Amongst the abalone fauna, *Haliotis mariae* are very common, while *H. unilateralis* and *H. arabiensis* are extremely rare (only single specimens of the latter taxa have been collected by K. Van Laethem). No specimens of *Haliotis rugosa* (*H. rugosa multiperforata* or *H. rugosa pustulata*) were found during these collection surveys, and we question whether this very shallow subtidal species is found in Oman (and U.A.E.). The rarity of *H. arabiensis* during these surveys is likely due to their general occurrence at depths of greater than 12 m, with few washing up in the intertidal zone. It is also much less common than *H. mariae* (S. Gori, personal observation). The six specimens from North Fujairah, U.A.E., tend towards a tan to brown coloration, and have none of the bright red, purple, orange or green colors seen in the specimens from the N. Salalah area of Oman.

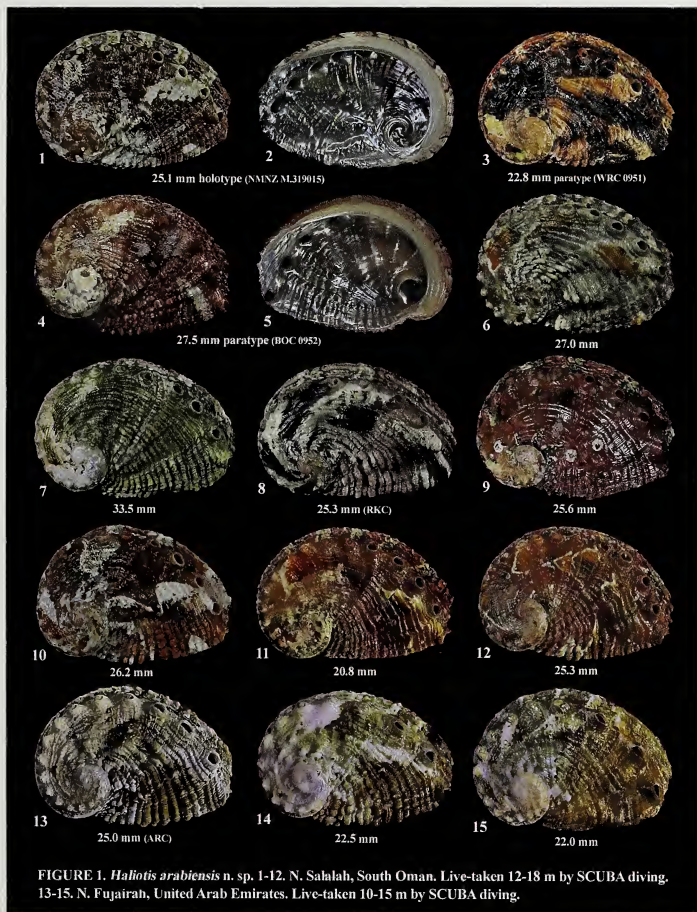
Note: Figure 2 on Plate 36, pg. 218 of *Abalone Worldwide Haliotidae* (Geiger & Owen, 2012), illustrates a specimen of *H. arabiensis* incorrectly identified as *H. mariae*.

ACKNOWLEDGEMENTS

Aaron Pan, Arjay Raffety and David P. Berschauer provided editorial guidance. Bob Kershaw provided photo images of hatchery produced *H. mariae* and one specimen of *H. arabiensis*. Arjay Raffety provided images of one specimen of *H. arabiensis*.

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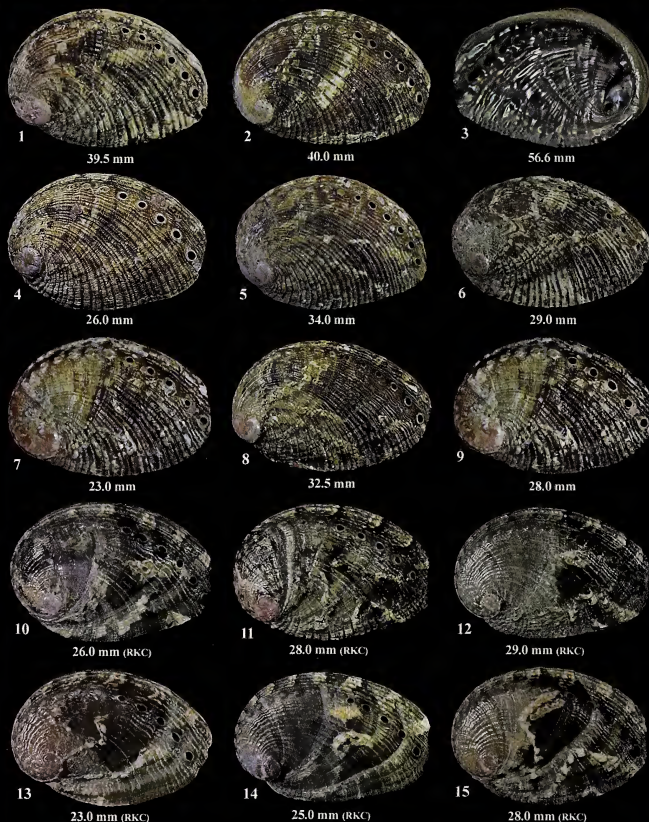


FIGURE 2. *Haliotis mariae*. 1-9. N. Salalah, South Oman. Beach collected from natural populations. 10-15. Hatchery cultured at Mirbat Bay, Oman. 1999-2000.

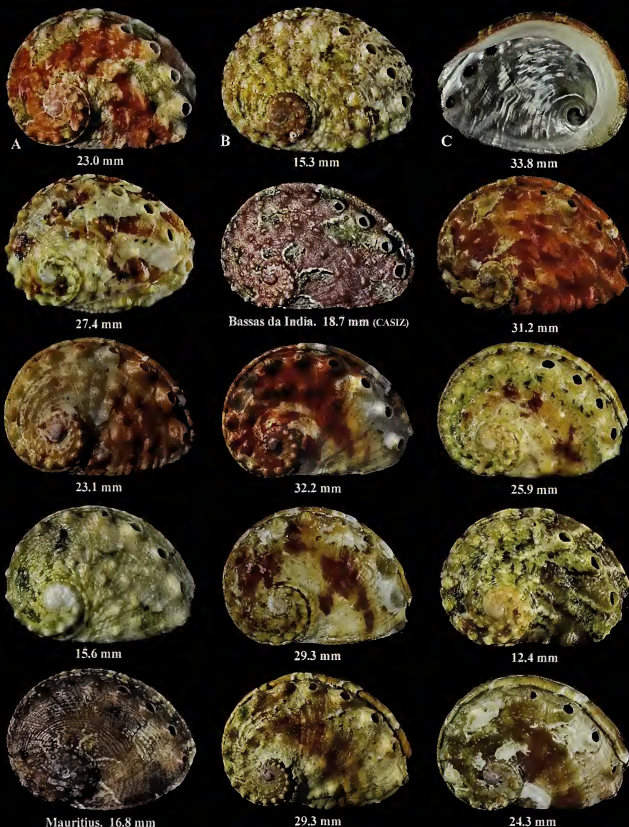


FIGURE 3. *Haliotis unilateralis*. Top Row. A-Mozambique. 10-20 m. B-Fernão Veloso, Mozambique. 10-20 m. C-Red Sea. 15 m. Rows 2-5. Red Sea area, unless marked otherwise. 1-40 m.

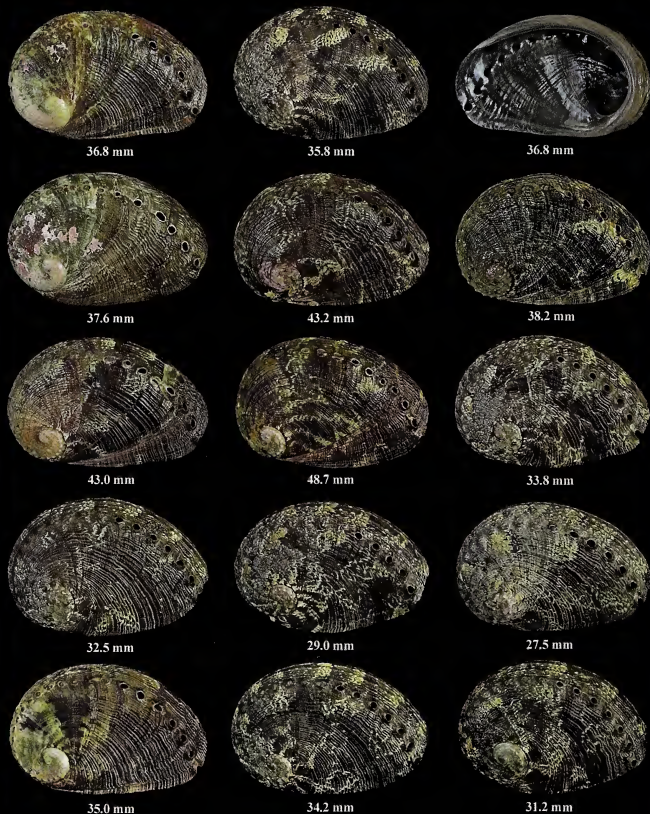


FIGURE 4. *Haliotis rugosa multiperforata* (Reeve, 1846). Broom, 35 km SW of Mukalla, Yemen. Live-taken by snorkeling, 2004-2006. Prior to 2013 known as *H. pustulata* Reeve, 1846 (see Introduction).



FIGURE 5. Differential Diagnosis

1-3, *Haliotis arabiensis* n. sp. South Oman. 4-6, *H. arabiensis* n. sp. United Arab Emirates. 7-9, *H. mariae*. South Oman. 10-12, *H. unilateralis*. South Oman. 13-15, *H. rugosa multiperforata*. Broom/Mukalla, Yemen.